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Final Report- NASA NAG 2-402

Cooled Far-IR and Submillimeter Heterodyne Mixers

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Research Accomplishments

- As part of our effort to optimize the design of open-structure Schottky diode mixers, we modeled the performance of the mixers as a function of whisker length and separation of the whisker antenna from the vertex of the whisker. We found that the optimal design has a coupling efficiency almost 50% higher than the conventional 4λ antenna with a 1.2λ vertex spacing.
- We designed and constructed a set of mixer blocks designed to work at the optimal settings determined from the model calculations. In the last year of the grant period, we modified the assembly jigging required to fabricate these new mixers with the necessary precision.
- In order to be useful for a range of astronomical projects, a high frequency Schottky mixer requires a powerful local oscillator capable of operating at frequencies reasonably close to those of astronomical interest. It is typically quite difficult to get an optically pumped far-IR laser to produce adequate power on a large selection of lines. In an effort to improve the tunability of our system, we worked to incorporate a more powerful CO₂ laser in our system and to develop new far-IR laser output couplers. Several of these improvements were later incorporated into a working local oscillator.
- We investigated a possible new source for tunable local oscillator signals in the far-IR. The scheme involves modulating a fixed frequency far-IR source by using it to illuminate a dielectric surface whose reflectivity is rapidly varied by a near-

IR diode laser.

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Personnel

The research of three graduate students and one postdoctoral fellow was supported by this grant. William F. Wall completed his PhD in 1991 and began an NRC postdoctoral fellowship at NASA-GSFC. John Howe also completed his PhD in 1991 and began a postdoctoral fellowship at the University of Maryland. Hsin-Piao Lin wrote an M.A. paper in Electrical Engineering based on work done with our group. Dr. Erich Grossmann came to the group after graduating in Physics from Caltech in 1988. He left in 1990 to take a staff position at NIST in Boulder.

Refereed Publications

OK Optically Illuminated Dielectric Interfaces as High Speed Far-Infrared Modulators, E.N. Grossman, Int. J. of IR and MM Waves, 10(7), 1989.

OK The Coupling of Submillimeter Corner-cube Antennas to Gaussian Beams, E.N. Grossman, Infrared Physics, 29(4), 875, 1989.